Acid Sulfate Soils Management Plan

Project
351-353 Barrenjoey Road, Newport NSW

Client Name
Atlen Construction Pty Ltd

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Should additional information that may impact on the findings of this report be encountered or site conditions change, Alliance reserves the right to review and amend this report.

Executive Summary

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Atlen Construction Pty Ltd to undertake an Acid Sulfate Soils Management Plan (ASSMP) at 351-353 Barrenjoey Road, Newport NSW (refer Figure 1, with the 'site' boundaries outlined in Figure 2).

At the commencement of the project, Alliance had the following project appreciation:

- Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing mainly iron sulfides and iron disulfides. Exposure of these soil sulfides to oxygen has the potential to produce sulfuric acid which can have a significant impact on the environment. Leaching of sulfuric acid into waterways can cause serious water quality problems, resulting in fish kills and also damage to infrastructure.
- Acid sulfate soils can be broken down into two types when can often be found together in the same soil profile. Actual Acid Sulfate Soils (AASS) are soils or sediments containing iron sulfides that are acidic due to the partial or total oxidation (aeration) with a pH of 4 or less in dry conditions. Potential Acid Sulfate Soils (PASS) are soils or sediments containing iron sulfides that have not yet oxidised and remain in predominantly anaerobic conditions generally below the groundwater table. The pH of PASS is commonly 5.5 or more, making them neutral or slightly alkaline.
- This report uses the term ASS interchangeably for PASS and AASS except where specifically referenced.
- It is understood that a current development proposal for construction of a multi-storey mixed use building comprising retails on the ground level, with residential above and two basement car park levels. The site is approximately 800 m^2. Alliance understands that an acid sulfate soils assessment of the site is required by the client to address acid sulfate concerns for the site in relation to proposed excavation relating to the construction of the residential building.
- This ASSMP is required to assist the client to address acid sulfate soils risks presented in Alliance (2022).

The objectives of this project were to:

- Document the procedures and standards to be followed to manage the risks posed by acid sulfate soils identified during previous investigations;
- Outline the management measures to be implemented to minimise the potential for adverse human health or environmental impacts resulting from the disturbance of ASS; and
- Manage the offsite disposal of excavated materials aligned to the NSW EPA Waste Classification Guidelines Part 1: Classifying Waste, November 2014 (NSW EPA, 2014a) and Waste Classification Guidelines Part 4: Acid Sulfate Soils (NSW EPA, 2014b)

The following scope of works was undertaken address the project objectives:

- A desktop review of previous reports; and
- Assessment of data and reporting.

The nominated scope of works was undertaken with reference to relevant sections of ASSMAC (1998), NASSG (2018), NSW EPA (2014a) and NSW EPA (2014b).

On completion of the treatment and reuse or offsite disposal of impacted material, a post works closure report is to be prepared. The report should include, but not be limited too, information relating to the:

- Works completed including final grade and depth to remaining ASS;
- Locations and construction methods for the treatment pad/s;
- Daily monitoring undertaken (soil and water)
- Volume of soil material excavated;
- Volume and rate of lime application to excavated soils;
- Volume and rate of lime application (if any) to effluent;
- Validation results for soil and surface water (if any);
- Unexpected finds or contingency measures implemented;
- Volume and waste classification of material removed from the site;
- Load tracking records:
- Waste tracking records; and
- Waste disposal records.

This report must be read in conjunction with the ***Important Information About This Report*** statements at the front of this report.

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1 Introduction

1.1 Background

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Atlen Construction Pty Ltd to prepare an Acid Sulfate Soils Management Plan (ASSMP) for proposed works at 351-353 Barrenjoey Road, Newport NSW (refer **Figure 1**, with the 'site' boundaries outlined in **Figure 2**).

At the commencement of the project, Alliance had the following project appreciation:

- Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing inorganic iron sulfides and iron disulfides, that when exposured.to oxygen, have the potential to produce sulfuric acid which can have a significant impact on the environment. Leaching of sulfuric acid into waterways can cause serious water quality problems, resulting in fish kills and also damage to infrastructure.
- Acid sulfate soils can be broken down into two types when can often be found together in the same soil profile. Actual Acid Sulfate Soils (AASS) are soils or sediments containing iron sulfides that are acidic due to the partial or total oxidation (aeration) with a pH of pH 4 or less in dry conditions. Potential Acid Sulfate Soils (PASS) are soils or sediments containing iron sulfides that have not yet oxidised and remain in predominantly anaerobic conditions generally below the groundwater table. The pH of PASS is commonly pH 5.5 or more, making them neutral or slightly alkaline.
- This report uses the term ASS interchangeably for PASS and AASS, except where specifically referenced.
- It is understood that a current development proposal for construction of a multi-storey mixed use building comprising retails on the ground level, with residential above and two basement car park levels. The site is approximately 800 m^2. Alliance understands that an acid sulfate soils assessment of the site is required by the Client to address acid sulfate concerns for the site in relation to proposed excavation relating to the construction of the residential building.
- This ASSMP is required to assist the Client to address acid sulfate soils risks presented in Alliance (2022).

1.2 Objectives

The objectives of this project were to:

- Document the procedures and standards to be followed to manage the risks posed by acid sulfate soils identified during previous investigations;
- Outline the management measures to be implemented to minimise the potential for adverse human health or environmental impacts resulting from the disturbance of ASS; and
- Manage the offsite disposal of excavated materials aligned to the NSW EPA (2014a) Waste Classification Guidelines Part 1: Classifying Waste and NSW EPA (2014b) Waste Classification Guidelines Part 4: Acid Sulfate Soils.

1.3 Scope of Work

The following scope of works was undertaken address the project objectives:

- A desktop review of previous reports; and
- Assessment of data and reporting.

The nominated scope of works was undertaken with reference to relevant sections of ASSMAC (1998), NASSG (2018), NSW EPA (2014a) and NSW EPA (2014b).

2 Site Identification

2.1 Site Details

Site identification details are presented in **Table 2.1**.

Table 2.1 Site Identification Details

Cadastral Identification	Lot 64 in DP1090224 & Lot 65, Section 5 in DP6248
Geographic Coordinates (SIX Maps)	33°39'17" S 151°19'13" E
Site Area	Approximately 800 m^2
Local Government Authority	Northern Beaches Council
Current Zoning	B2 – Local Centre

2.2 Site Layout

The layout of the site is present in **Figure 2**. The layout plan also includes locations on site of:

- Site access points;
- Current buildings / structures; and
- Surface water bodies on site and immediately adjacent to the site.

3 Site Environmental Setting

3.1 Geology

The Department of Mineral Resources Geological Survey of NSW Sydney 1:250,000 Geological Series Sheet 9130 (Edition 3) 1966, indicated that the site is likely to be underlain by Quaternary (Qa) alluvium, consisting of gravel, sand, silt, and clay.

3.2 Site Topography and Elevation

The site topography is generally flat (RL 10 mAHD) with minor slopes facing to the east and south-east.

3.3 Acid Sulfate Soils

Review of the Department of Land and Water Conservation NSW Acid Sulfate Soil Risk Map for Mona Vale (1:25,000 scale) indicates that the site lies within an area mapped as:

- Disturbed Terrain - which may include filled areas, which often occur during reclamation of low-lying swamps for urban development. Other disturbed terrain includes areas which have been mined, dredged, or have undergone heavy ground disturbance through general urban development or construction of dams or levees. Soil investigations are required to assess these areas for acid sulfate potential.

Further assessment of acid sulfate soils, in the context of this project is considered warranted.

3.4 Hydrogeology and Hydrology

A review of maps held on file by Alliance, indicated that the nearest surface waterbody to the site is the Tasman Sea (Newport Beach), located approximately 300m east of the site.

Based on prevailing site topography, groundwater flow direction in the vicinity of the site is inferred to be towards the east-south-east.

A search of https://realtimedata.waternsw.com.au/water.stm indicated that there are eleven registered groundwater bores located within a 500m radius of the site. The closest five groundwater bores to the site and their intended uses are outlined below:

- GW106070 – domestic;
- GW111119 – monitoring bore, standing water level – 4.8m bgs;
- GW114958 – monitoring bore;
- GW114959 – monitoring bore; and
- GW114960 – monitoring bore.

A copy of the online search record is presented in **Appendix A**.

4 Summary of Previous Acid Sulfate Soil Investigation

Investigation of ASS at the site was previously completed by Alliance, with findings documented in the following report:

- Alliance (2022), Acid Sulfate Soils Assessment, 351-353 Barrenjoey Road, Newport NSW', dated July 2020, Ref: 10827-ER-2-1.

The objective of the assessment was to assess site soils for the presence of ASS within the proposed construction footprint at the site and provide recommendations on further assessment or management should ASS be identified.

The scope of works utilised for the assessment consisted of:

- A review of available acid sulfate soils risk planning maps, previous investigation reports, and associated mapping and databases;
- A preliminary desktop assessment to consider the possibility of ASS being present onsite;
- An intrusive site investigation to a maximum depth of 6 m below ground level (as nominated by the Client) to establish ground conditions and to facilitate the collection of representative soil samples;
- Laboratory analysis of selected samples collected during the field investigations; and
- Preparation of a report documenting the investigation findings in accordance with Acid Sulfate Soils Manual 1998 (ASSMAC, 1998) and the National Acid Sulfate Soil Guidance (Australian Government, 2018).

Intrusive investigation was performed at four (4) borehole locations to a maximum depth of 6.0 mbgl. Soil samples were collected at 0.5m intervals during auger advancement at each borehole location for subsequent laboratory analysis.

Preliminary field screen assessment of forty-eight (48) soil samples was completed by the laboratory. Reported field pH values (pH_F) in soil samples were >pH 5.0, indicating that actual acid sulfate soils (AASS) were unlikely to be present in soils onsite to a depth of 6.0 mbgl. pH values reported for soil samples following peroxide oxidation (pH_{FOX}) were greater than the screening criterion of pH 3.5. Three (3) soil samples reported an extreme reaction to hydrogen peroxide, while a pH reduction greater than 1.0 pH unit (i.e. $pH_F - pH_{FOX}$) was identified for thirteen (13) samples analysed. As a results of the field screen assessment, potential acid sulfate soils (PASS) were considered to be potential present within site soils to 6.0 mbgl.

Nine (9) soil samples were selected for quantitative ASS analysis using Chromium Reducible Sulfur Suite analysis by the analytical laboratory. Results were compared with the ASSMAC (1998) action criteria pertaining to *sandy loams to light clay* and a disturbed soil mass > 1,000 tonnes of soil. The sulfur trail and acid trail analytical results for the soil samples analysed were less than the adopted action criteria (0.03 %S and 18 mol H+ / tonne, respectively), with the exception of soil samples BH03-4.0 and BH03-6.0, which recorded sulfur trail of 0.06 % S & 0.04 % S oxidisable and acid trail 40 mol H+ / tonne & 22 mol H+ / tonne, above the action criteria adopted. Results indicate the presence of AASS and PASS collected from boreholes BH03, indicate the presence of AASS and PASS from the site surface to proposed excavation depth within soils at the site.

Based on the findings of the ASS Assessment, Alliance recommended that an Acid Sulfate Soil Management Plan (ASSMP) be prepared to:

- Document the procedures and standards to be followed to manage the risks posed by potential ASS identified during construction;
- Outline the management measures to be implemented to minimise the potential for adverse environmental impacts resulting from the disturbance of ASS; and
- Manage the offsite disposal of excavated materials aligned to the NSW EPA Waste Classification Guidelines Part 1: Classifying Waste, November 2014 (NSW EPA, 2014a) and Waste Classification Guidelines Part 4: Acid Sulfate Soils (NSW EPA, 2014b).

5 ASS Screening & Assessment Criteria

Assessment of ASS is generally divided into two components:

- Measuring the pH values of soil to understand the likely presence of PASS; and
- Chemical analysis, by a NATA accredited laboratory, to confirm the presence/absence of ASS.

The indicators of ASS and the assessment criteria are provided in *Acid Sulfate Soil Management Guidelines*, NSW Acid Sulfate Soil Management Advisory Committee, August 1998 (ASSMAC, 1998), and have been summarised in **Sections 5.1** and **5.2**.

5.1 Screening

Field screening can be utilised to assess the effectiveness of the treatment prior to sample collection for submission to the testing laboratory for validation and/or waste classification purposes. A summary of the values and the associated management measures are outlined in **Table 6.1**.

Table 5.1 pHF and pHFOX Indicators of ASS

pHF Value	pHFOX Value	pH Change	Effervescence	Management
Greater than 5.5	Greater than 4.5	Less than 2	Non to mild	AASS and PASS unlikely. No action required.
Greater than 5.6	less than 3	Greater than 2	Mild - extreme	PASS suitable for burial below the water table within 16 hours.
Greater than 4.5 but less than 6	Greater than 3.5	Less than 1	Non to mild	AASS and PASS unlikely. No action required.
Greater than 4 but less than 5.6	less than 3	Greater than 1	Mild - strong	Some AASS possible and PASS may exist. Material requires treatment.
Less than or equal to 4	Less than 4	Less than 1	Non to mild	AASS are likely. Material requires treatment.
Less than or equal to 4	less than 3	Greater than 2	Mild - strong	AASS and PASS likely. Material requires treatment.

5.2 Assessment Criteria

The action criteria for ASS are dependent on the volume of material as well as the soil type to be excavated. **Table 5.2** outlines the action criteria provided in the *Acid Sulfate Soil Manual,* August 1998, (ASSMAC). As greater than 1,000 tonnes of soils is proposed for excavation during the proposed development works, Alliance have applied action criteria of 0.03%S oxidisable and 18 mol H^+ / tonne in the assessment and management of soils at the site.

Table 5.2 Action Criteria Based on ASS Soil Analysis for Three Broad Texture Categories

Type of Material		*Action Criteria 1-1000 tonnes disturbed*		*Action Criteria if more than 1000 tonnes disturbed*	
Texture range.McDonald et al. (1990)	*Approx. clay content (%< 0.002 mm)*	*Sulfur trail % S oxidisable (oven-dry basis) eg SCRos or SPos*	*Acid trail mol H^+/tonne (oven-dry basis) eg, TPA or TSA*	*Sulfur trail % S oxidisable (oven-dry basis) eg SCRos or SPos*	*Acid trail mol H^+/tonne (oven-dry basis) eg, TPA or TSA*
Coarse Texture Sands to loamy sands	≤5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5 - 40	0.06	36	0.03	18
Fine Texture Medium to heavy clays and silty clays	≥40	0.1	62	0.03	18

5.3 Waste Disposal Criteria

NSW EPA (2014b) indicates that offsite disposal of ASS can be managed in three ways:

1. Excavation and offsite disposal of PASS by placement under the water table within 24 hours (must be received at the proposed disposal location within 16 hours);

   OR

2. Onsite treatment with subsequent validation sampling confirming neutralising of the ASS and assessment for chemical parameters as well;

   OR

3. Disposal of untreated ASS to a facility licenced to accept the untreated ASS.

In addition to the ASS assessment, NSW EPA stipulate that a waste classification analysis be carried out on material requiring offsite disposal in accordance with the NSW EPA (2014a) *Waste Classification Guidelines*.

Should offsite disposal of PASS for reburial or offsite disposal of untreated ASS at a licenced facility be selected as a disposal option, the proposed facility should be contacted to determine any licence specific conditions on disposal that may exist. The initial site screening, prior to offsite disposal of PASS for reburial, will generally consist of field screening of ASS, with measurements of pH_F required to be pH 5.6 or higher. Regardless of the classification of the soil, disposal will be at the discretion of the receiving facility. Approval to dispose of the excavated material at the receiving facility will be required prior to transport from the site.

5.3.1 Assessment Criteria for Treated ASS

Following application of lime and subsequent mixing, samples of the treated soil are to be collected at a rate outlined in **Section 6.9**. Initial sample analysis should be undertaken using field screening techniques (refer **Section 6.5**) with the results compared to assessment criteria outlined in **Table 5.1**. Field screening results (pH_F and pH_{FOX}) less than pH 5.5 and pH 4.5, respectively, are to trigger further lime application, re-mixing, and re-screening.

Sample results returning field screening results (pH_F and pH_{FOX}) greater than pH 5.5 and pH 4.5, respectively, should be submitted for laboratory analysis for pH_F and pH_{FOX} in combination with waste classification sample collection, as outlined in **Section 6.9**. The laboratory results are then to be assessed against the criteria outlined in **Table 5.2**.

5.4 Effluent Disposal Criteria

Should effluent be generated from the area of ASS treatment, or associated with any dewatering activity, effluent will require chemical assessment prior to discharge. The relevant criteria for assessment of effluent to be discharged to stormwater are outlined in the NEPM (2013) and ANZG (2018) . The trigger values for marine water for a level of protection for 95% of species is considered appropriate given the location of the site and proximity to Tasman Sea (Newport Beach).

Dewatering of groundwater from the site must only be undertaken following approval, in the form of a licence, from Water NSW. Discharge of groundwater, post-treatment, into the municipal stormwater system should be undertaken following approval from Northern Beaches Council . If groundwater is expected to be encountered during the proposed development, a groundwater management plan would be required. Alternatively, a licenced waste removal contractor could be engaged to remove the effluent subject to sampling assessment outlined by the chosen contractor.

6 Soil Management Strategy

6.1 Overview

The following management strategies have been prepared in general accordance with guidance provided in *Acid Sulfate Soil Management Guidelines*, NSW Acid Sulfate Soil Management Advisory Committee, August 1998 (ASSMAC, 1998) and the NSW DECC (2007) *Acid Sulfate Soil Remediation Guidelines for Coastal Floodplains in New South Wales* (NSW DECC, 2007).

Based on the findings of the previous ASS Assessment (refer **Section 4**) the soil material is likely to be excavated and disposed offsite as ASS (either treated or untreated, but subject to the licenced disposal facility conditions and waste classification).

Treatment of ASS (where required) will be conducted in designated treatment areas using the liming rate provided in **Section 6.7.**

6.2 Roles and Responsibilities

The assigned Principal Contractor must:

- be responsible for the proposed project work until the work is completed;
- ensure that persons involved with proposed project work have undertaken occupational health and safety training;
- keep records of induction training for site workers and site-specific training;
- ensure that subcontractors (if any) provide safe work method statements for the activities for which they are engaged;
- monitor subcontractors to ensure that they are complying with the safe work method statements; and
- maintain a hazardous substance register for hazardous substances used or present on the site.

The Principal Contractor is responsible for co-ordinating health and safety activities for the project. Other responsibilities of the Principal Contractor include:

- compliance with work health and safety and environmental legislation, regulations, standards, codes, and the site-specific rules relating to safety contained in this ASSMP;
- ensuring that sufficient funds are available to procure the necessary health and safety equipment such as personal protective equipment (PPE);
- managing accident and emergency procedures; and
- managing workplace injury management and rehabilitation.

The Principal Contractor has the authority to suspend or modify work practices and administrate disciplinary actions for individuals whose conduct does not meet the minimum site requirements set forth herein.

It should be noted that lime should be treated with care as incorrect use and/ or handling can result in adverse impacts on human health and the surrounding environment. As such persons associated with application or treatment of the ASS should be suitably trained for the type of work being undertaken. A job safety analysis (JSA) (or a safe work method statement (SWMS)) should be in place prior to undertaking works involving ASS. The JSA or SWMS should be reviewed and approved by the principal contractor.

A suitably qualified and experienced environmental consultant is required to assess the treatment of ASS including collection of validation samples. Further the environmental consultant will be responsible for providing a waste classification assessment for offsite disposal of material.

6.3 Excavation

Excavation work will be required within the proposed locations to depths of approximately 6.0m bgl and Installation of building foundations including potential drilling to bedrock. **Table 6.2** presents the appropriate management strategy for the excavation of material located onsite. A graphic representation of the soil material is provided in borehole logs from Alliance (2022), which are present in **Appendix B.**

Table 6.2 Management Requirements for Soil Materials

Designation	Approximate depth (m bgl)	Soil type	Management
Onsite Treatment/ offsite disposal	Site surface to excavation depth	Clay and sandy clay	Material excavated and transported to the designated pads for lime treatment for offsite disposal. Once treated, sample excavated material as outlined in **Section 7.8** for re-use onsite or waste classification and offsite disposal. OR Excavation and re-burial beneath groundwater at an offsite licensed facility (subject to acceptance and pH screening results). OR extraction and offsite disposal to a facility licenced to accept untreated ASS (subject to disposal facility's specific conditions)

Sample collection and analysis will be required to provide appropriate waste classifications for all material to be disposed offsite. Results would require comparison to the NSW EPA *Waste Classification Guidelines* (NSW EPA, 2014a).

The ASS requiring treatment (if selected as the management option) will be excavated and placed in designated treatment areas, with lime application at the rate outlined in **Section 6.7.** Following completion of excavation to the design levels, a sample is to be collected from the existing surface and subject to field screening. Should the results indicate ASS, lime will be spread across the area of excavation at the rates outlined in **Section 6.7**. The surface will then be covered the same day with geofabric.

6.4 Stockpiling

The excavated soil material is to be placed into designated ASS treatment areas if not transported directly offsite to an appropriately licenced facility. The stockpiled material should be placed in layers to allow application of lime and associated mixing as outlined in **Section 6.7**. The stockpiles are to be covered to minimise potential rainfall contact will ASS or treated ASS material. Once the stockpiled material has been treated, as outlined in **Section 6.7,** validation samples should be collected by an appropriately experienced environmental consultant and transported to a NATA accredited laboratory for analysis. Stockpiled material is to remain in the designated area until the NATA accredited laboratory reports indicate that the stockpiled material has been successfully treated and is suitable for reuse onsite or waste classification for offsite disposal, as outlined in **Section 6.9**.

Records of sources of excavated material and the location of the treatment areas should be maintained as outlined in **Section 8**.

6.5 Field Screening

Onsite field screening is a procedure available to monitor the effectiveness of the initial treatment method and to reduce the reoccurrence of ASS validation results failing. The first component of the procedure includes adding deionised water to the pH_F soil sample in a shallow test tube or similar and mix such that a grout mix paste is generated. Insert the calibrated pH meter and record the data.

The second component of the field screening (pH_{FOX}) requires the addition of peroxide to the second sample from the same stockpile. The peroxide is to be 30% hydrogen peroxide adjusted to pH between pH 4.5 and pH 5.5. The pH_{FOX} test should be conducted in a heat resistant test tube or similar as vigorous reactions can result in generation of temperatures greater than 80°C. A few millilitres of hydrogen peroxide should be added to cover the soil and the mixture stirred. Hydrogen peroxide should be slowly added (dependant on the reaction) until a grout like paste is generated. The calibrated pH meter should be insert in to the mixture and data recorded.

Comparison of pH_F and the pH_{Fox} results with the trigger levels in **Section 5.1** will determine whether the stockpiled material has likely been successfully treated for ASS, or if the stockpiled material requires application of additional lime and mixing.

Once the field screening results indicate that the stockpiled material has been successfully treated as outlined in **Table 5.1,** validation samples should be collected by an appropriately experienced environmental consultant and transported to a NATA accredited laboratory for analysis. Stockpiled material is to remain in the designated area until the NATA accredited laboratory reports indicate that the stockpile has been successfully treated and is suitable for reuse onsite or adequately waste classified for offsite disposal, as outlined in **Section 6.9**.

It should be noted that hydrogen peroxide and pH adjusting chemicals should be treated with care as incorrect use and/or handling can result in adverse impacts on human health. As such, person associated with field screening should be suitably trained with a safe work method statement or similar generated. This document will require review and approval by the principal contractor prior to undertaking the works. Further, any waste generated should be handled and managed as outlined in **Section 5.3** or as outlined in the waste management procedures provided in the overarching environmental management plan for the project.

6.6 Preparation of the Treatment Area

Prior to placement of soil in the designated treatment area/s, the area/s (or pad/s) will be graded such that water will flow to one corner with a sump installed to allow extraction of the water (if required). Water could be generated during dust suppression or rainfall events and should be designed with consideration of the size of the pad/s. A plastic liner (two layers of HDPE) with no leakage at overlaps is to be installed across the treatment pad/s. Hay bales, earthen mounds or similar will be placed around the designated treatment pad/s with the plastic overtopping the bales, earthen mounds or similar secured. This will effectively provide a bunded area/s. Coarse crushed sandstone, coarse crushed gravel or similar drainage medium is to be placed over the plastic liner and is to be a minimum of 0.2 m thick. Subdividing large treatment pads may be preferable to enable sequencing of treatment batches and validation of the same.

All excavated material that is AASS and PASS and is unsuitable for offsite disposal for burial (at an appropriately licenced facility) is to be immediately placed in the treatment pad/s on the drainage material.

Tarps or HDPE plastic should be available to cover the stockpiles to minimise rainfall contacting the ASS. This will minimise the size of the required sump of the containment areas.

6.7 Treatment of ASS

The excavated material requiring treatment is to be placed in the bunded area in a layer not greater than 0.3 m thick. Lime is to be applied to the soil at a liming rate of:

- 3.0 kg of $CaCO_3$ / tonne of ASS

This application rate assumes fine agricultural lime less than 200 µm (micron). Application of alternate lime would require an assessment of the effective neutralising value with the assessment of suitability undertaken by a suitably experience environmental consultant. Further, it should be noted that, as validation data becomes available from the treated soils, the liming rate may require adjustment based on this additional information.

The lime requires mixing through the soil matrix to effectively neutralise the ASS. The mixing should be undertaken immediately following application to the soil.

Should available treatment area/s be insufficient to receive the material requiring treatment at less than 0.3 m in thickness, additional material requiring treatment is to be placed in 0.3 m layers on the treatment pad/s after lime application and mixing is undertaken on the lower 0.3 m layer (following collection of treatment validation soil samples).

Alternatively, treated soil can be removed from site for storage at a suitably licenced facility (licenced to accept PASS and AASS) while waiting waste classification results.

Following treatment of the excavated material, validation samples are to be collected by an appropriately experienced environmental consultant at the rate outlined in **Section 6.9**. Should the validation samples indicate that the ASS has not been effectively neutralised, further lime application and mixing followed by additional validation sample collection will be required. An amended liming rate will be determined based on the failed analytical results (if required).

It should be noted that lime should be treated with care as incorrect use and/ or handling can result in adverse impacts on human health and the surrounding environment. As such, person associated with application or treatment of the ASS should be suitably trained with a safe work method statement or similar generated. This document will require review and approval by the principal contractor for the project.

If periods of high rainfall are forecast, the stockpiles will be covered with measures implemented to divert non-impacted stormwater from the treatment pad/s.

6.8 Treatment of Effluent

Effluent generated from the treatment area will require assessment and potential treatment prior to offsite discharge. Alternatively, a licenced liquid waste removal contractor could be engaged to remove the effluent.

Where the effluent is proposed for discharge to stormwater, sampling is required to assess treatment requirements (if any) prior to discharge. Water samples are to be collected by a suitably qualified and experienced environmental consultant. The water samples are to be subjected to field screening (using a calibrated water quality meter) and laboratory analysis, as a minimum for:

- pH, dissolved oxygen, temperature, electric conductivity (water quality meter);

- Metals (aluminium, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc) (laboratory);
- PAH;
- TRH;
- BTEX;
- pH (laboratory);
- Electrical Conductivity; and
- Total dissolved solids (laboratory).

Discharge of effluent into Council stormwater system should be undertaken following an approval from Northern Beaches Council. A groundwater dewatering management plan would be required prior to undertaking the dewatering works.

Where required, lime is to be added to the effluent to adjust the pH to the level acceptable for discharge. It is considered likely that adjusting the pH will result in precipitation of metals concentrations should they exceed the NEPM (2013) water quality guidelines. A suitably qualified and experienced environmental consultant should be engaged to assist in determining the appropriate application rate for treatment of the effluent. Items to be considered are the type of neutralising agent (e.g., agricultural lime has a low solubility in water) and the method of application. Further, care should be exercised such that the water doesn't become alkaline.

Additional water samples will be required from the treated effluent prior to discharge to confirm successful treatment.

6.9 Off-Site Disposal

It should be noted that acceptance of the waste is at the discretion of the receiving body. As such, the waste classification assessment report is to be submitted to the proposed disposal facility, for approval, prior to transport off site.

Wastes are to be classified, managed, and disposed in accordance with the relevant council and NSW EPA guidelines and Legislation.

6.9.1 Sample Collection

Soil material proposed for offsite disposal is to be sampled at the rate outlined in **Table 6.9.1.**

Table 6.9.1. Stockpile Sampling Density for ASS Treatment, Validation and Waste Classification

Stockpile Volume (m^3)	Number of Samples
<75	3
75 - <100	4
100 - <125	5
125 - <150	6
150 - <175	7

Stockpile Volume (m^3)	Number of Samples
175 - <200	8

Treatment validation soil samples are to be analysed for:

- Field screen (pHf/pHfox).

Waste classification soil samples (if required) are to be analysed for

- metals (arsenic, cadmium, chromium, lead, mercury, and nickel);
- total recoverable hydrocarbons (TRH);
- polycyclic aromatic hydrocarbons (PAH);
- benzene, toluene, ethylbenzene, and xylene (BTEX);
- organochlorine pesticides (OCP);
- polychlorinated biphenyls (PCB); and
- Asbestos.

Soil samples are to be collected and waste classification reports are to be completed by a suitably qualified and experienced environmental consultant. The analytical results obtained laboratory analysis require comparison to the contaminant concentrations outlined in NSW EPA (2014a) *Waste Classification Guidelines Part 1: Classifying Waste*. The landfill should be informed that the ASS has been treated in accordance with the neutralising techniques outlined in the ASSMAC (1998), the ASSMP, and that the waste has also been classified in accordance with the NSW EPA (2014a).

6.9.2 Offsite Disposal for Reburial

Although not recommended by Alliance, PASS which could be present onsite and proposed for removal and offsite reburial below the water table, will require transport and acceptance at a suitably licenced facility within 16 hours. Each truck load will require measurement of the pH of the soil prior to leaving site. Where the soil is less than pH 5.6 (or alternate pH as directed by the receiving facility), the load will be considered unsuitable for offsite disposal and will be placed in the treatment areas. Where the pH of the load is greater than pH 5.6 (or the alternate pH as outlined by the receiving facility), the material will be considered suitable for offsite disposal. Records of pH measurement and the corresponding truck registration details are to be maintained as outlined in **Section 8**. Further, a record sheet recording pH measurements at the time of loading, as well as other relevant details, will be retained in the truck for providing to the landfill facility. If additional forms are required by the receiving body, the associated documentation will require completion as required.

The sample collected from each truck load will be subjected to pH screening using a calibrated meter. Deionised water will be added to the soil sample in a shallow test tube or similar and mixed such that a grout mix paste is generated. The pH probe will be inserted, and the data recorded, and any additional records required by the receiving facility should be provided.

Each load will be covered and transported to the licenced landfill facility immediately after excavation and pH testing (to confirm suitability for offsite disposal as PASS). No loads are to leave site after 2:30pm to allow sufficient time to arrive at the disposal facility prior to its closure. In the event that a load is rejected, or the load does not arrive at the disposal facility on the same day (i.e. vehicle breakdown or similar) the load is to be returned to the site for treatment as outlined in **Section 6.7**. The load and waste tracking records are to be updated accordingly (refer **Section 8**).

7 Dewatering Management Strategy

Alliance understands that the proposed development is unlikely to require dewatering during bulk excavation works. Any dewatering of groundwater from the site should be undertaken following an approval to abstract from Department of Industry – Water. Discharge of groundwater into the municipal stormwater system should be undertaken following an approval from Northern Beaches Council. A groundwater dewatering management plan will be required prior to undertaking any dewatering works.

8 Monitoring

Soil sample collection and review of data to assess the effectiveness of the treatment of ASS is required and should be undertaken at the rate outlined in **Section 6.9**. Where the samples are to assess the successful treatment of ASS, analysis is required by a laboratory accredited by National Association of Testing Authorities (NATA) for pH_F, pH_{FOX}, and chromium reducible sulfur (if required by the receiving facility).

Effluent samples (if generated) are also to be submitted to a NATA accredited laboratory for the parameters outlined in **Section 6.8**.

Monitoring of site works (to be included in the final report as outlined in **Section 11**) is to include, but not be limited to, records of:

- Field screening results (pH_F and pH_{FOX}) for the various soil layers;
- Date and volume of soil material excavated;
- Location of placement of the excavated material;
- Treatment measures implemented (if ASS) including liming rate, mixing methodology and date mixed;
- Validation analytical results confirming treatment of the ASS (if any);
- Amendments to treatment measures following review of the failed validation analytical results (if required);
- Disposal location of the excavated material;
- Records of truck and loads leaving the site;
- Waste tracking documentation;
- Waste disposal receipts;
- Copies of specific documentation required by the receiving facility (if any);
- Water quality meter measurements (including date) for effluent in sumps associated with the treatment pad/s (if relevant); and
- Calibration records for meters.

8.1 Soil

Records of encountered soil types will be compared to the laboratory results for effectiveness of the field screening as well as used as a guide for amending liming rates (if required).

Prior to offsite disposal of soil material, a waste classification assessment report will be required for submission to the receiving body.

8.1.1 AASS

Sample collection and review of the data to assess the success of the treatment of ASS is required and should be undertaken at the rate outlined in **Table 6.9.1**. Due to the likely volume of soil material requiring treatment, a robust recording system will be required.

In addition, waste tracking documentation (where relevant) will be required as well as disposal receipts from the receiving facility. Tracking of all truck loads leaving or entering the site will be required with the following information recorded:

- Date and time;
- Truck registration;
- Approximate volume;
- Soil type;
- Disposal location; and

8.1.2 PASS

Soil material considered to be PASS and proposed for offsite disposal and reburial (refer **Section 6.9.2**) will require additional sampling and data collection. Each load of soil proposed for offsite disposal to a suitably licenced facility will require pH testing (refer **Section 6.5**) with the data recorded on the tracking sheet. This sheet is to be retained by the truck and provided to the receiving facility on arrival. Additional documentation may be required by the receiving facility and should be completed and retained with the vehicle for delivery with each load (as required).

8.2 Surface Water and Groundwater

Groundwater seepage into drains is the most significant pathway for acid discharge from acid sulfate soil landscapes. The anticipated depth of excavation is considered unlikely to extend beyond the groundwater table. As such, changes to site drainage may have implications for acid generation onsite. When acid sulfate soils are drained, the sulfide can become exposed to oxygen and produce sulfuric acid. This can directly affect the ecology of surrounding wetlands and the export of acid from acid sulfate soils and the drainage pattern of any out-flowing streams. Consideration of potential changes to the hydrologic regime may be necessary to predict the magnitude of the impacts on acid sulfate soils, and in the design/redesign of drainage or water management systems.

If the excavation works are resulting in the generation of acid sulfate soils, remediation by injection of an alkaline solution must be completed to buffer any acid generation.

If effluent is generated and directed to the holding sump of the treatment pad/s, this effluent can be reused on the treatment pad/s for dust suppression. Alternatively, the water would require assessment using a water quality meter and may be suitable for use for dust suppression on the remainder of the site. Advice should be sought from an experienced environmental consultant and the assessment of the results will be required to provide guidance on the likelihood for adverse impact on soils and vegetation.

Should offsite discharge be the proposed management strategy, water samples would be required for submission to a NATA accredited laboratory for analysis for the parameters outlined in **Section 6.8.** The water samples are to be collected by an experienced environmental consultant. The analytical results are to be compared to the relevant guidelines (refer **Section 5.4**). Following comparison of the laboratory results to the respective guidelines, there may be a requirement for treatment of the effluent prior to discharge. Following treatment additional monitoring samples may be required. A water quality report should be prepared prior to discharge.

Should discharge into local stormwater be the proposed management strategy, an approval would be required from the Central Coast Council. An assessment of discharge water may be required. Where the effluent is not suitable for discharge, or immediate disposal is required, collection by a suitably licensed water transport company for disposal to a suitably licenced disposal facility will be required. Records of water quality monitoring, volume generated, volume removed, waste disposal records, waste tracking records, water quality reports and waste disposal receipts are required.

9 Contingencies

While this ASSMP provides a framework for management of the soil material based on the current understanding of the site conditions, potential changes to site conditions may occur during site works. Some potential contingencies are outlined in **Sections 9.1** to **9.3.**

9.1 Soil Excavations

Extended delays due to equipment failure has the potential for ASS material within excavations and trenches to be exposed to air resulting in oxidation of the PASS and generation of AASS. This could result in acidification of the soil and/or groundwater. In the event of extended delays, the existing surface should be kept wet, or lime applied to the excavation batter walls at the approximate rates outlined in **Section 6.7**.

During excavation there is a potential that ASS may spill from the excavation equipment, transport equipment or from the treatment area during mixing (low likelihood). Spilt ASS has the potential to impact on surface soils and/or groundwater (if effluent is generated). Spilt soil should be collected, transported (where required) and placed in the treatment area as soon as practical.

Increased size of excavations due to changed site conditions have the potential for excavations to remain open for longer period of time and the surrounding groundwater to be depressed. This could result in the oxidation of PASS in the walls and base of the excavation. Acidification of the soil, groundwater and potential impacts on ground infrastructure that may be installed could occur. In the event of extended delays, the soil should be kept wet, or lime applied to the excavation batter walls at the rate outlined in **Section 6.7.**

Should a load of PASS be rejected at the licenced receiving facility, the load is to be transported back to site for placement in the treatment pads as soon as possible (and on the same day). An investigation is to be undertaken into the reason for the rejection. Appropriate measures are to be implemented to reduce the likelihood of reoccurrence.

9.2 Stockpiles

Extra soil material generated during excavation work could result in insufficient stockpiling area with the designated treatment area. This could result in excavated PASS oxidising with potential impact on surface soils and/or groundwater (if effluent is generated) if placed outside the treatment area. Excavation should cease once the treatment area is at capacity until temporary storage of the ASS, such as skip bins, is organised for containment. Following treatment, successful validation, and removal of material from the treatment area, the temporary contained material should be placed in the treatment area for application of lime and mixing as outlined in **Section 6.7.**

There is potential that insufficient lime is available at the time of excavation. his could result in PASS oxidising within the treatment area. Should the material contained with the treatment area not be treated with lime, acid effluent may be generated during dust suppression activities or during precipitation. To minimise the potential for generation of acidic effluent, when lime is not available for treatment, stockpiled material is to be covered at all times until an alternate lime source is found.

The mixing methodology may not result in even distribution of lime throughout the ASS matrix. Should the validation sample results indicate ineffective mixing, alternate measure will be used including the use of rotary hoe attachment.

Lime application may not occur in the event of equipment breakdown or delayed delivery. This could result in oxidation of PASS within the treatment area and the generation of acid effluent during dust suppression activities or rain events. To minimise the potential for generation of acidic effluent, when lime is not available for treatment, stockpiled material is to be covered at all times until an alternate lime source is found and successfully mixed.

9.3 Surface Water

Unexpected precipitation has the potential to result in effluent generation from the stockpiled soil in the treatment area (assuming the stockpiled material is not covered). There is a potential that this effluent may be impacted if remediation activities have not been completed. While a sump or similar containment measure exists, the potential for overtopping cannot be precluded. As such, tarps or HDPE plastic should be placed over the stockpiled material as soon as possible to minimise further stormwater contact with the soil. Stormwater runoff that has not contacted the stockpiled material is suitable for management through the existing stormwater management systems.

There is a potential that an unforeseen rainfall event could fill open excavations. Should the excavations be open for less than 24 hours or the contingency measures outlined in **Section 9.1** be implemented, the potential for acid effluent generation from the excavations is considered unlikely. However, where the contingencies outlined above have not been implemented and the excavation have been open for greater than 24 hours, acidic effluent may be generated. The water should be collected and contained with analysis by a suitably experienced and qualified environmental consultant as outlined in **Section 6.8**.

10 Post Construction Monitoring

Post construction monitoring will only be conducted if groundwater treatment is required and will consist of monthly monitoring events from groundwater monitoring wells onsite. Water samples will be collected by a suitable trained and experienced environmental consultant with monitoring continuing until rectification measures have been successful.

11 Reporting

On completion of the treatment and reuse or offsite disposal of impacted material, a post works closure report is to be prepared. The report should include, but not be limited too, information relating to the:

- Works completed including final grade and depth to remaining ASS;
- Locations and construction methods for the treatment pad/s;
- Daily monitoring undertaken (soil and water)
- Volume of soil material excavated;
- Volume and rate of lime application to excavated soils;
- Volume and rate of lime application (if any) to effluent;
- Validation results for soil and surface water (if any);
- Unexpected finds or contingency measures implemented;
- Volume and waste classification of material removed from the site;
- Load tracking records:
- Waste tracking records; and
- Waste disposal records.

This report must be read in conjunction with the ***Important Information About This Report*** statements at the front of this report.

12 References

Alliance 2021, ‘Acid Sulfate Soils Assessment, 351-353 Barrenjoey Road, Newport NSW’, dated July 2020, Ref: 10827-ER-2-1

ANZG 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

NSW DECC 2007, Acid Sulfate Soil Remediation Guidelines for Coastal Floodplains in New South Wales

NSW Acid Sulfate Soil Management Advisory Committee 1998, Acid Sulfate Soil Management Guidelines, August 1998

NSW EPA 2014a, Waste Classification Guidelines Part 1: Classifying Waste, November 2014

NSW EPA 2014b, Waste Classification Guidelines Part 4: Acid Sulfate Soils, November 2014

NSW EPA 2016, ‘Environmental Guidelines: Solid Waste Landfills, Second Edition’, dated 2016, Ref: EPA 2016/0259

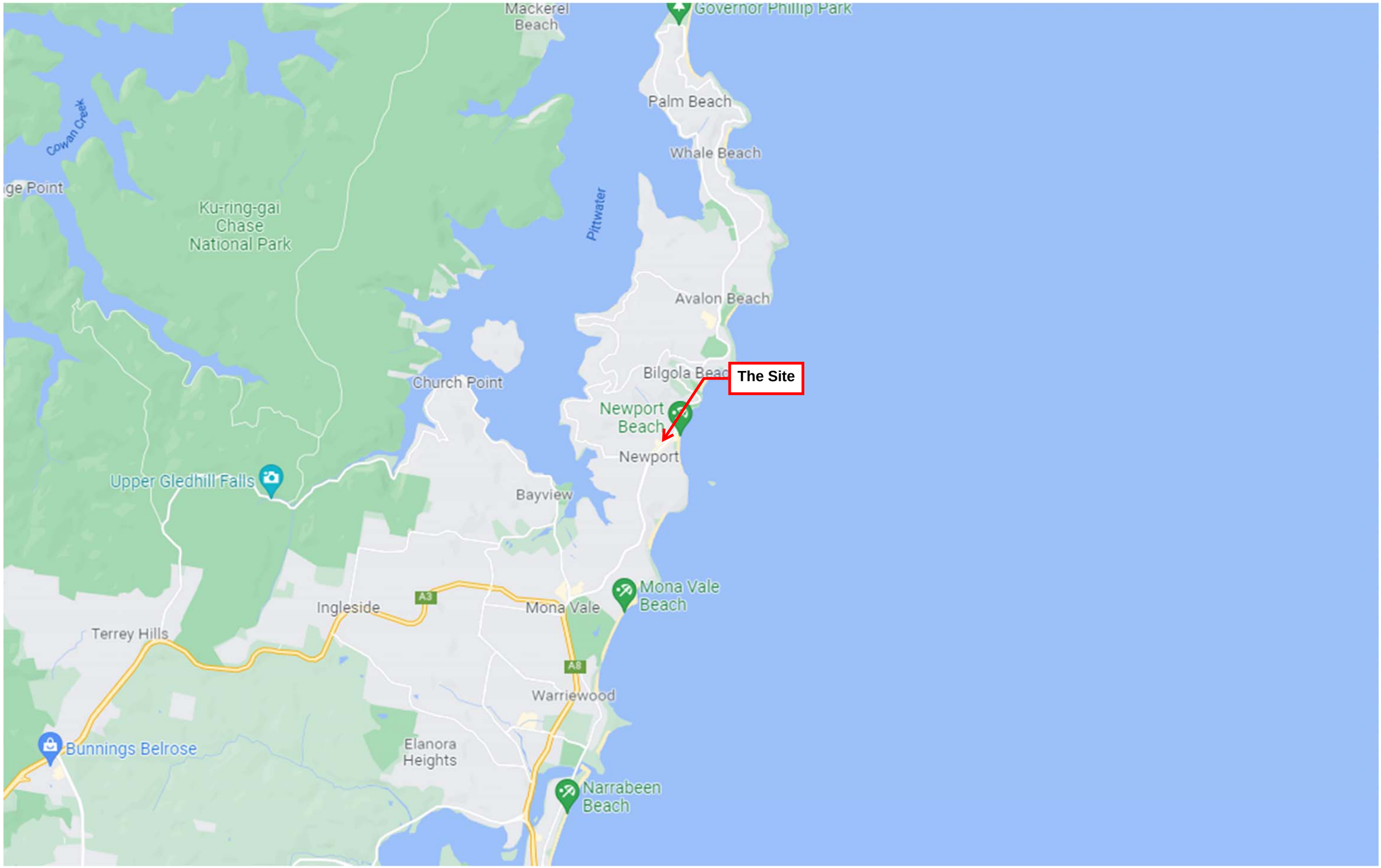
NSW EPA 2017, ‘Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme (3rd edition)’, dated October 2017, Ref: EPA 2017P0269.

NSW EPA 2020, ‘Assessment and management of hazardous ground gases’ dated May 2020, Ref: EPA 2019P2047

Sullivan, L., Ward, N., Toppler, N., and Lancaster, G. 2018, ‘National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual’ dated June 2018

VIC EPA 2009, ‘Industrial Waste Resource Guidelines’ dated June 2009, Ref: IWRG702.

FIGURES



Site Locality

alliance	Client Name:	Atlen Construction Pty Ltd	Figure Number:	1
	Project Name:	Acid Sulfate Soils Management Plan	Figure Date:	31 January 2022
	Project Location:	351-353 Barrenjoey Road, Newport	Report Number:	14429-ER-1-2

N

Borehole Locations

alliance	Client Name:	Atlen Construction Pty Ltd	Figure Number:	2	N
	Project Name:	Acid Sulfate Soils Management Plan	Figure Date:	31 January 2022	
	Project Location:	351-353 Barrenjoey Road, Newport	Report Number:	14429-ER-1-2	

APPENDIX A – Groundwater Records

WaterNSW

home help contact customise

State Overview

State Overview

Rivers and Streams

favourites search download sites find a site

⊞ Real Time Data - Riv...

Daily River Reports

⊞ Daily River Reports

Dams

favourites search download sites find a site

⊞ Real Time Data - Maj...

Groundwater (Telemetered data)

favourites search download sites

contact WaterNSW

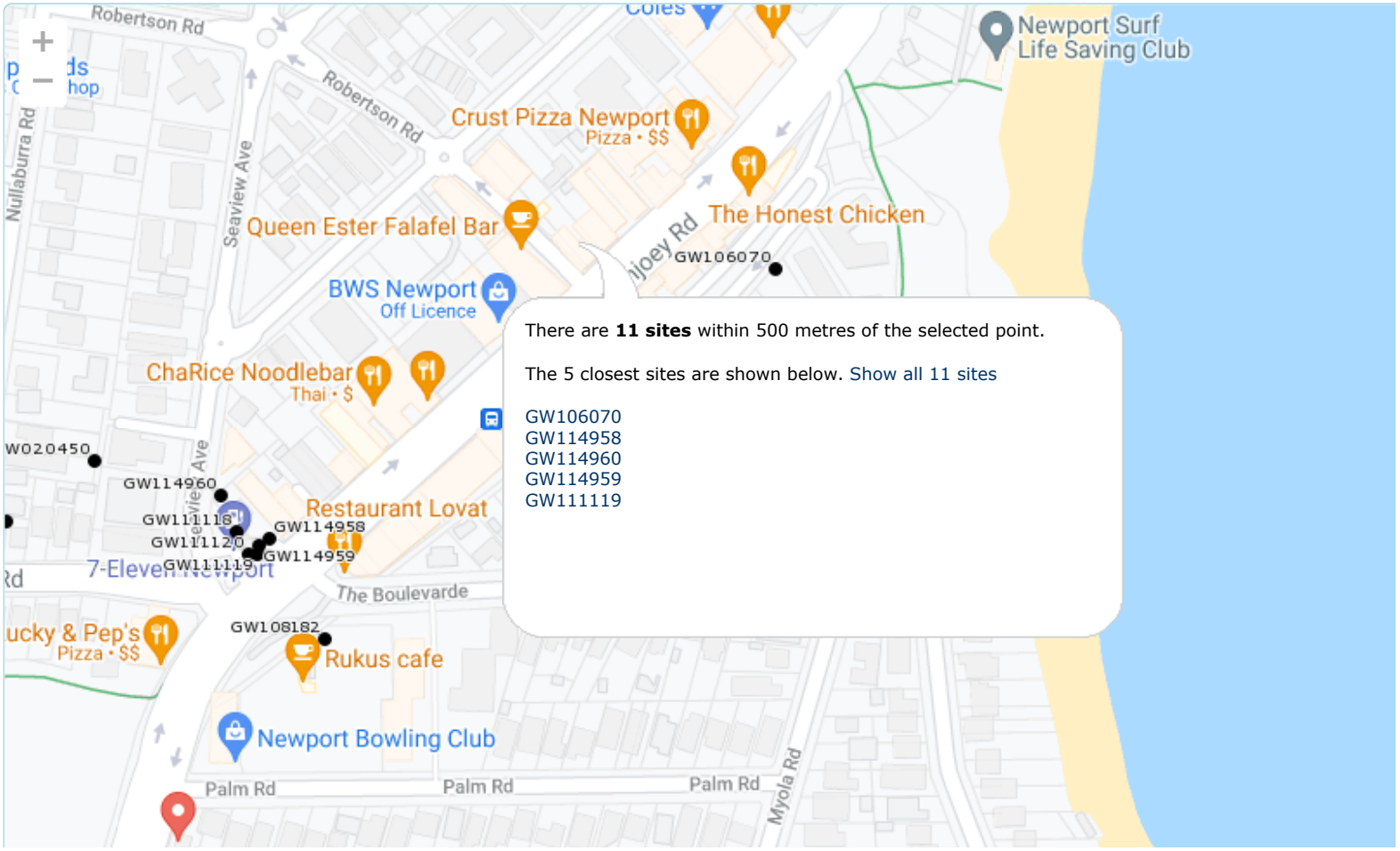
All Groundwater Site Details

ALL GROUNDWATER MAP

bookmark this page

All data times are Eastern Standard Time

Map Info



WaterNSW
Work Summary

GW114958

Licence:
Licence Status:

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid
Owner Type: Private

Commenced Date:
Completion Date: 27/09/2010
Final Depth: 10.90 m
Drilled Depth: 11.00 m

Contractor Name: Numac Drilling Services Pty Ltd
Driller: Unkown Unknown
Assistant Driller:

Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBERLAND	NARRABEEN	46/5/6248
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6274677.000
Easting: 344076.000
Latitude: 33°39'22.9"S
Longitude: 151°19'06.2"E

GS Map: -
MGA Zone: 56
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	10.90	50			Auger - Solid Flight

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	FILL,MOIST DARK BROWN,LOOSE,SILT,CLAY	Fill	
1.00	4.00	3.00	SANDY CLAY MOIST,MOTTLED,SANDSTONE	Sandy Clay	
4.00	11.00	7.00	SANDSTONE, MOIST, PALE TAN,WEATERED	Sandstone	

Remarks

27/09/2010: Form A Remarks:
Coordinates provided by LAS,
L. Franchi
12/08/2015: Nat Carling, 12-Aug-2015; Updated work type & coordinate source, fixed rock type error.

***** End of GW114958 *****

WaterNSW
Work Summary

GW111119

Licence:
Licence Status:

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid
Owner Type: Private

Commenced Date:
Completion Date: 09/07/2010
Final Depth: 7.00 m
Drilled Depth: 7.00 m

Contractor Name: Numac Drilling Services Pty Ltd
Driller: Simon Benjamin Tant
Assistant Driller: Dean Ryan

Property:
GWMA:
GW Zone:
Standing Water Level (m): 4.800
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBERLAND	NARRABEEN	B//322724
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6274668.000
Easting: 344069.000
Latitude: 33°39'23.2"S
Longitude: 151°19'05.9"E

GS Map: -
MGA Zone: 56
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	7.00	55			Auger - Solid Flight
1		Annulus	Waterworn/Rounded	3.50	7.00				Graded
1	1	Casing	Pvc Class 18	0.00	4.00	55			Seated on Bottom, Other
1	1	Opening	Slots - Horizontal	4.00	7.00	55		0	Casing - Machine Slotted, PVC Class 18, Other, SL: 40.0mm, A: 3.80mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
5.00	7.00	2.00	Unknown	4.80					

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	FILL	Fill	
1.00	5.00	4.00	SAND CLAYEY DRY	Sand	
5.00	6.50	1.50	SAND MOIST CLAYEY	Sand	
6.50	7.00	0.50	SAND SATURATED CLAYEY	Sand	

***** End of GW111119 *****

WaterNSW
Work Summary

GW106070

Licence:
Licence Status:
Authorised Purpose(s):
Intended Purpose(s): DOMESTIC

Work Type: Spear
Work Status: Supply Obtained
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date: 16/04/2004
Final Depth: 2.20 m
Drilled Depth: 2.20 m

Contractor Name:
Driller: Warren James Warwick
Assistant Driller:

Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s): 2.000

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBERLAND	NARRABEEN	21//7424
Licensed:			

Region: 10 - Sydney South Coast
River Basin: 212 - HAWKESBURY RIVER
Area/District:
CMA Map: 9130-1S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6274836.000
Easting: 344365.000
Latitude: 33°39'17.9"S
Longitude: 151°19'17.5"E

GS Map: -
MGA Zone: 56
Coordinate Source: GIS - Geogra

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	2.20	90			(Unknown)
1	1	Opening	Screen - Gauze/Mesh	1.40	2.00	40		0	Steel - ERW, A: 0.06mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
1.40	2.00	0.60	Unknown			2.00			

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.60	0.60	sandy loam	Sandy Clay Loam	
0.60	2.00	1.40	sand, coarse	Sand	
2.00	2.20	0.20	gravel	Gravel	
2.20	2.20	0.00	rock	Rock	

Remarks

26/11/2009: updated from original form A

***** End of GW106070 *****

WaterNSW
Work Summary

GW114960

Licence:
Licence Status:

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Hand Auger
Owner Type: Private

Commenced Date:
Completion Date: 28/09/2010
Final Depth: 8.00 m
Drilled Depth: 8.00 m

Contractor Name: Numac Drilling Services Pty Ltd
Driller: Unkown Unknown
Assistant Driller:

Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBERLAND	NARRABEEN	46/5/6248
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6274702.000
Easting: 344048.000
Latitude: 33°39'22.1"S
Longitude: 151°19'05.1"E

GS Map: -
MGA Zone: 56
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	8.00	50			Hand Auger

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.10	0.10	CONCRETE	Fill	
0.10	0.75	0.65	FILL,MOIST DARK BROWN,LOOSE,SAND,SANDSTONE	Fill	
0.75	0.85	0.10	CLAYEY SAND	Clayey Sand	
0.85	2.40	1.55	SANDY CLAY,MINOR IRONSTONE	Sandy Clay	
2.40	8.00	5.60	SANDSTONE, SLIGHTLY MOIST,PALE GREY AND RED	Sandstone	

Remarks

27/07/2015: Coordinates provided by LAS.
12/08/2015: Nat Carling, 12-Aug-2015; Updated work type & coordinate source, fixed rock type error.

***** End of GW114960 *****

WaterNSW
Work Summary

GW114959

Licence:
Licence Status:

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Hand Auger
Owner Type: Private

Commenced Date:
Completion Date: 27/09/2010
Final Depth: 9.00 m
Drilled Depth: 9.00 m

Contractor Name: Numac
Driller: Unkown Unknown
Assistant Driller:

Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBERLAND	NARRABEEN	46/5/6248
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6274673.000
Easting: 344071.000
Latitude: 33°39'23.0"S
Longitude: 151°19'06.0"E

GS Map: -
MGA Zone: 56
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	9.00	50			Hand Auger

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.50	1.50	FILL MOIST,DARK BROWN,STEEL	Fill	
1.50	2.00	0.50	SANDSTONE SLIGHTLY MOIST	Sandstone	
2.00	2.70	0.70	SANDY CLAY	Sandy Clay	
2.70	2.90	0.20	CLAYEY SAND	Clayey Sand	
2.90	3.00	0.10	SLIGHTLY MOIST SAND	Sand	
3.00	3.50	0.50	SANDSTONE RED TO BROWN	Sandstone	
3.50	9.00	5.50	SANDSTONE TAN TO PALE, TAN	Sandstone	

Remarks

27/09/2010: Form A Remarks:
Coordinates provided by LAS.
12/08/2015: Nat Carling, 12-Aug-2015; Updated work type & coordinate source, fixed rock type error.

***** End of GW114959 *****

APPENDIX B – Alliance (2022) Borehole Logs

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No: BH01
Sheet: 1 of 1
Job No: 14429

Test Pit Log

Client: Alten Construction Pty Ltd
Project: Acid Sulfate Soils Assessment
Location: 351-353 Barrenjoey Road, Newport NSW **Hole Location:** Refer to Figure 2
Started: 17/01/2022
Finished: 17/01/2022
Test Pit Size: 0.1 m

Rig Type: Solid Flight Auger **Hole Coordinates** E, N **Driller:** **Logged:** JW
RL Surface: m **Contractor:** Alliance **Bearing:** --- **Checked:** MA

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
CC						CONCRETE				
SFA						FILL: Sandy CLAY with trace gravels, brown, stiff, moist.	0.5m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
			1		CLS	Sandy CLAY, orange, stiff, moist.	1.0m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
							1.5m			
			2		SW-SC	Clayey SAND, grey, loose, moist to wet with depth.	2.0m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments) were not observed, with the exception of waterlogged soils at depth.
							2.5m			
			3				3.0m			
							3.5m			
			4				4.0m			
	▼ GW Encountered						4.5m			
			5				5.0m			
							5.5m			
			6				6.0m			
						Test Pit BH01 terminated at 6m				
			7							

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No: BH02
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Job No: 14429

Test Pit Log

Client: Alten Construction Pty Ltd
Project: Acid Sulfate Soils Assessment
Location: 351-353 Barrenjoey Road, Newport NSW **Hole Location:** Refer to Figure 2
Started: 17/01/2022
Finished: 17/01/2022
Test Pit Size: 0.1 m

Rig Type: Solid Flight Auger **Hole Coordinates** E, N **Driller:** **Logged:** JW
RL Surface: m **Contractor:** Alliance **Bearing:** --- **Checked:** MA

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
CC						CONCRETE				
SFA						FILL: Sandy CLAY with trace gravels, brown, stiff, moist.	0.5m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
			1		CLS	Sandy CLAY, orange, stiff, moist.	1.0m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
							1.5m			
			2				2.0m			
					SW-SC	Clayey SAND, grey, loose, moist to wet with depth.	2.5m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments) were not observed, with the exception of waterlogged soils at depth.
			3				3.0m			
							3.5m			
			4				4.0m			
							4.5m			
			5				5.0m			
							5.5m			
			6				6.0m			
						Test Pit BH02 terminated at 6m				
			7							

1. NON CORED BOREHOLE 14429 ENVIRO LOGS.GPJ GINT STD AUSTRALIA.GDT 28/1/22

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No: BH03
Sheet: 1 of 1
Job No: 14429

Test Pit Log

Client: Alten Construction Pty Ltd
Project: Acid Sulfate Soils Assessment
Location: 351-353 Barrenjoey Road, Newport NSW **Hole Location:** Refer to Figure 2
Started: 17/01/2022
Finished: 17/01/2022
Test Pit Size: 0.1 m

Rig Type: Solid Flight Auger **Hole Coordinates** E, N **Driller:** **Logged:** JW
RL Surface: m **Contractor:** Alliance **Bearing:** --- **Checked:** MA

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
SFA			0			FILL: Sandy CLAY, dark brown, soft, moist.	0.5m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
			1				1.0m			
							1.5m			
			2		CLS	Sandy CLAY, brown/orange becoming grey with depth, very stiff, moist.	2.0m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
							2.5m			
			3				3.0m			
							3.5m			
			4				4.0m			
							4.5m			
			5				5.0m			
							5.5m			
			6				6.0m			
			7			Test Pit BH03 terminated at 6m				

1. NON CORED BOREHOLE 14429 ENVIRO LOGS.GPJ GINT STD AUSTRALIA.GDT 28/1/22

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No: BH04
Sheet: 1 of 1
Job No: 14429

Test Pit Log

Client: Alten Construction Pty Ltd
Project: Acid Sulfate Soils Assessment
Location: 351-353 Barrenjoey Road, Newport NSW **Hole Location:** Refer to Figure 2
Started: 17/01/2022
Finished: 17/01/2022
Test Pit Size: 0.1 m

Rig Type: Solid Flight Auger **Hole Coordinates** E, N **Driller:** **Logged:** JW
RL Surface: m **Contractor:** Alliance **Bearing:** --- **Checked:** MA

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
SFA						FILL: Sandy CLAY, dark brown, soft, moist.				Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
					CLS	Sandy CLAY, brown/orange becoming grey with depth, very stiff, moist.	0.5m			Visual indicators of acid sulfate soils (i.e. soils containing pale yellow deposits / coatings of jarosite, shell fragments and waterlogged sands) were not observed.
			1				1.0m			
							1.5m			
			2				2.0m			
							2.5m			
			3				3.0m			
							3.5m			
			4				4.0m			
							4.5m			
			5				5.0m			
							5.5m			
			6				6.0m			
						Test Pit BH04 terminated at 6m				
			7							

1. NON CORED BOREHOLE 14429 ENVIRO LOGS.GPJ GINT STD AUSTRALIA.GDT 28/1/22